DDP USER EXPERIENCE PROFILES

INPUT

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DISTRIBUTED DATA PROCESSING
USER EXPERIENCE PROFILES

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DISTRIBUTED DATA PROCESSING
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LIST OF EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- This report is produced by INPUT as part of the Planning Service For Computer and Communications Users. The report presents five user experience profiles of Distributed Data Processing (DDP) systems implemented during the last two to five years in the following industry sectors:

  - Banking
  - Discrete Manufacturing
  - Health Care
  - Process Manufacturing
  - Retailing

- Before selecting this report topic, INPUT polled clients to the above subscription program in order to identify subject areas of mutual interest. DDP and its related areas were consistently mentioned.

- Thus far in 1978, INPUT has conducted approximately 200 on-site interviews of DDP users in support of both custom and company funded research. The systems selected for analysis and profiling in this report were judged to be among the most interesting DDP installations INPUT had encountered during the course of performing our research.

- The same basic questionnaire was used for all five respondents, and all were completed by a combination of on-site visits and telephone interviews with the senior DP executive at each firm.

- The conclusions and recommendations for users that appear in Section II represent a summary of INPUT's current perspective on DDP which has been derived from our research to date.

- Inquiries and comments on the information presented in this report are invited from clients.

A. DEFINITION OF DDP

- INPUT has been unable to find a consensus among both users and vendors as to a definition of DDP. It appears to be a concept that is uniquely structured to satisfy individual user requirements.

- Nonetheless, as a result of our work in this area, we offer the following hybrid definition:

  - "Distributed processing is the deployment of programmable intelligence in order to perform data processing functions where they can be accomplished most effectively, through the electronic interconnection of computers and terminals, arranged in a telecommunications network adapted to the user's characteristics."

II EXECUTIVE SUMMARY

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A. MAJOR CONCLUSIONS

1. DDP OUTLOOK

- Although DDP has been employed by a selected group of end users for ten or more years, it has been only over the last two to three years that wide spread implementation has begun.

- The acceptance of the DDP concept has been largely limited to the Fortune class of industrial companies and major services firms in banking, insurance and retailing.

- Exceptions to the preceding are to be found in two areas:

  - Third party services vendors who are increasingly offering DDP network attachment to small users, thus affording them an opportunity to reap the benefits of distributed processing with limited investment in time and resources and,

  - Certain "enlightened" managements of companies usually in the $100-500 million annual sales range who have adopted DDP methods as part of an operating strategy to initiate or sustain relatively rapid rates of growth.

- In general, INPUT believes that the banking, process and discrete manufacturing sectors will continue to lead the way in adopting DDP techniques.

- The services sector, with the exception of retailing, appear to be lagging in moving toward DDP.

- The concept's adoption has been evolutionary with recent acceleration occasioned in part by the sharp price/performance improvements in intelligence based products, including programmable terminals, microcomputers and minicomputers.

- INPUT believes that the rate of price/performance improvements in both minicomputer and mainframe classes of machines will continue at average annual rates of 15% and 25% respectively for the foreseeable future.

- Accordingly, hardware costs will assume a lower level of relative importance vis-a-vis the costs associated with both applications and network software, operating personnel, systems design and implementation, and network communications costs.

- INPUT regards the lack of communications expertise by users, particularly within smaller companies, as a major deterrent currently to the wider acceptance of DDP.

- It is conceivable that over the long-term, AT&T's recently introduced Advanced Communications Service (if permitted to be offered by the Federal Communications Commission) could go a long way in alleviating these and other difficulties; e.g., a lack of hardware and protocol standards.

- Users continue to be dissatisfied with the lack of equipment standards among vendors as well as the software and documentation difficulties that traditional mainframe users experience in initially attempting to work with minicomputers.

- However, this has not prevented companies from changing to DDP by either:

  - Reluctantly selecting a single vendor and adopting the vendor's standards or,

  - Developing their own system from the "ground up" after convincing themselves that suppliers could not (or would not) satisfy their performance and service requirements.

- There appears to be a singular lack among many of the more recent converts to DDP of hard quantitative measures substantiating the concept's anticipated cost performance benefits. We attribute this in part to the:

  - Pilot status of many of these installations.

  - The greater than expected difficulties and costs encountered in implementing distributed processing systems.

  - Lack of post-auditing procedures within corporations.

- Nonetheless, growing evidence is accumulating that DDP does solve more problems than it creates and that its acceptance by users is growing, although not at the rate that vendor pronouncements or some media puffery would seem to suggest.

2. DRIVING FORCES

- Key factors that INPUT believes are contributing to increased distributed processing implementation include:

  - Its use as an aid in facilitating the decentralization of an operating entity.

- Remote user dissatisfaction with the timeliness of centralized reporting.

- The inherent difficulties of accurately entering and manipulating data at computer centers that are physically removed from their remote source.

- A desire to slow the rate of mainframe utilization and subsequent upgrade.

- Dramatic increases in the cost/performance capabilities of computers coupled with increasing integration of intelligence within various peripheral products.

- DDP's use in supporting aggressive growth plans; particularly by retailers,

- Being able to build redundancy and fail safe features into critical operations at costs that are affordable.

- The potentially favorable financial impact (balance sheet and profit and loss) resulting from reducing inventories, increasing accounts receivable turnover, improved cash management and reduced personnel requirements; e.g., keypunch operators.

- Another driving force not to be overlooked is the momentum generated by a variety of vendors (most recently IBM with its Series/1 minicomputer) in attracting more user attention to distributed processing.

3. OTHER KEY ISSUES

- Although distributed processing suggests greater local control and management of the data entry and processing functions, it does not necessarily suggest increased DP autonomy at the remote site. Centralized control of

equipment procurement and systems development will continue to be carried out at corporate or divisional headquarters.

- Over the longer term, the degree of remote site autonomy will be directly related to management's organizational philosophy; i.e., centralized versus decentralized control.

- A broad consensus of users believes that there are no viable data base management software (DBMS) systems available today to support host or remote (minicomputer) management and control requirements. Until such time as these products become available, their absence represents something of a deterrent to the adoption or expansion of DDP within user organizations.

- Users emphasize continuously the need to engage in detailed planning in implementing their DDP programs, and several expressed disappointment in having selected the lowest bidder in hardware procurement, particularly when dealing with relatively new products offered by smaller vendors.

- Remote pilot installations have required anywhere from 3-12 months to become operational and have almost uniformly been underestimated in terms of the amount of actual difficulty encountered in getting them up and running.

  - Management may require as much as one year of operating data from pilot installations prior to activating additional remote sites.

- Remote site operating environments, particularly in retail stores and warehouses, have frequently proven to be more hostile to DP equipment than initially anticipated either by the user or the vendor.

- Some users expressed dissatisfaction with telephone company communications services, citing:

  - Reliability (particularly in rural areas).

- High tariffs and,

- A lack of equipment standards from one operating company to another

as reasons for their examining alternate network solutions.

- The communications implications of DDP from both a technical and cost point of view will continue to be the single most pivotal issue controlling the rate of acceptance of the concept.

- The use of a remote computing services vendor offering DDP network facilities and leased remote site equipment appears to be a very low risk and cost effective way in which to evaluate and demonstrate the potential benefits of some facets of DDP.

- Smoother and more error free DDP operations have resulted from:

  - Added efforts to properly train remote site user personnel.

  - Using equipment that is technically transparent to users.

- The major risk that users expose themselves to in considering the smaller vendors of DDP equipment appear to be in the field maintenance, documentation and support areas. Designing with products that are very early in their life cycle and unproven also presents an added element of risk to be considered.

B. USER RECOMMENDATIONS

- INPUT is convinced that DDP as a concept is gaining increased acceptance, particularly in banking, manufacturing and retailing, and must be seriously examined for implementation by users with a potential need.

- DDP should be considered as both a tactical and strategic management tool and examined (and sold internally) for its merits in this context.

- The axiom that..."the lowest bidder may eventually deliver the most expensive system..." should be remembered particularly when considering:

  - Reliability.

  - Hardware and software compatibility.

  - Field maintenance.

  - Documentation and support.

- Users would be wise to exercise caution when considering "first generation" DDP products, a number of which contributed to unforeseen delays and cost overruns. INPUT would expect these early difficulties to be alleviated in subsequent new product introductions.

- The level of DP experience at many remote sites is frequently extremely limited, and attention should be paid to designing a remote node with as much user transparency as possible.

- Vendor claims notwithstanding, available DBMS systems have met with generally negative user reviews. The need to distribute data bases should be examined with this current product limitation in mind.

- Networking and communications appear to be the least understood technical and cost areas encountered when discussing DDP. As such they demand greater efforts on the parts of users to master. In order to begin facilitating that understanding, all planning and control for data processing and communications should be combined under common management.

- The DP Manager should regard each piece of intelligence based equipment to be purchased as a potential node in a future network. This thinking should extend particularly to the office environment and encompass word processing, private automatic branch exchange (PABX) equipment and other forms of non-data communications.

  - DP management should become involved in acquisitions and plans that impact the "future node" concept.

- The amount of time required for systems design, specification, vendor selection and pilot testing of initial DDP systems has been universally underestimated. As a function of the complexity of the proposed system, users should be prepared for a one and one-half to three year implementation period.

- There is certainly no one right way to budget and account for data processing expense in a DDP environment. However, few companies seem capable of currently identifying all EDP expenses. Before distributing data processing it would be helpful to determine these expenses in order to judge more concretely whether DDP implementation will have met cost/performance expectations.

III USER EXPERIENCE PROFILES

III USER EXPERIENCE PROFILES

A. BANKING

1. INTRODUCTION

- The banking industry has employed DDP methods for at least a decade and is regarded by INPUT as being in the vanguard of using this technique.

- Minicomputers supporting host processors at headquarters, in conjunction with minicomputers or microcomputers at remote sites, have provided cost effective solutions to growing DP requirements in banking.

  - Additionally, DDP has served to assist in off-loading the mainframe and reducing the rate of capacity utilization.

- The bank discussed in the following profile has been employing DDP for several years in order to reduce teller time per transaction and reduce inter-office telephone calls occasioned by demand deposit and time deposit activities.

- Although the use of automated teller machines (ATM) is only now in a pilot mode, tying ATMs onto the DDP network at some future date is expected to facilitate the adoption of electronic funds transfer (EFT) techniques.

2. BANK OVERVIEW

- Security Pacific National Bank, headquartered in Los Angeles, is a full service retail national and international bank with operations in more than 20 foreign countries.

- It is the second largest bank in California and the tenth largest in the United States. With 528 banking offices at the end of 1977, it also has the second largest banking office system domestically.

  - Banking offices have been opened at the rate of 20 per year over the last several years exclusive of acquisitions.

- Employees number approximately 19,000 with $14.9 billion in deposits at the end of 1977. Assets are in excess of $18 billion.

- Systems software and applications personnel number approximately 12 in support of the bank's DDP efforts, which is referred to as the Bank Terminal System.

3. DDP BACKGROUND

- The bank's efforts in DDP date back to about 1974 when it became clear that methods had to be adopted to cope with the steadily increasing volume of consumer transactions occasioned by both demand and time deposit accounts and loan activity.

- A monetary savings could be realized by utilizing interactive minicomputers to support a network of terminals located at banking offices.

- Furthermore, as more banking offices were opened (with concomitant additions to transaction volume), clusters of minicomputers could be added to the system in a modular fashion in order to accommodate the increased volume.

- In addition, perhaps the major reason behind the move to DDP was as a result of the redundancy that the concept affords at a cost significantly below that of a large mainframe utilizing standard front end communications controllers.

- A competitive minicomputer system was also considered but not selected due to limitations of the configuration. All functions were to be performed in one processor with the second unit functioning as a "hot backup."

- The alternate approach that was examined and selected was a DDP configuration, centered around multiple redundant minicomputer clusters that were configured to handle both the on-line transactions and communications functions at the host site, independent of the bank's 370/168 three megabyte machines used primarily for batch functions.

- Each of the banking offices would have a programmable teller controller handling both administrative and teller terminals. ATMs could be subsequently added at each banking office and tied to the communications front end by means of an asynchronous line protocol.

- A pilot study was conducted and the minicomputer cluster system subsequently recommended to senior planning committees within the bank. Final approval came from the Office of the Chairman.

- The primary factors in justifying the system included:

  - Savings in inter-bank telephone calls.

  - Overdraft protection.

  - Reducing the average time required for each customer transaction.

- Other key elements in selecting DDP included:

  - Ease of expansion.

- Modularity (particularly in facilitating troubleshooting).

- "Fail soft" operation through redundancy.

- Design flexibility.

- The minicomputer vendor selected was General Automation (GA) for the following reasons:

  - Lower estimated cost and time to implement the system.

  - Physical proximity to the bank's headquarters in Los Angeles.

  - Prior experience with DDP in banking through its work with the Bank of America.

- Banking office equipment was supplied by Incoterm and included 16K byte controllers operating on sottware downline loaded from the host. The controller interfaces with 4-8 teller terminals and 1-2 administrative terminals. Both terminals are the same except for keyboard differences.

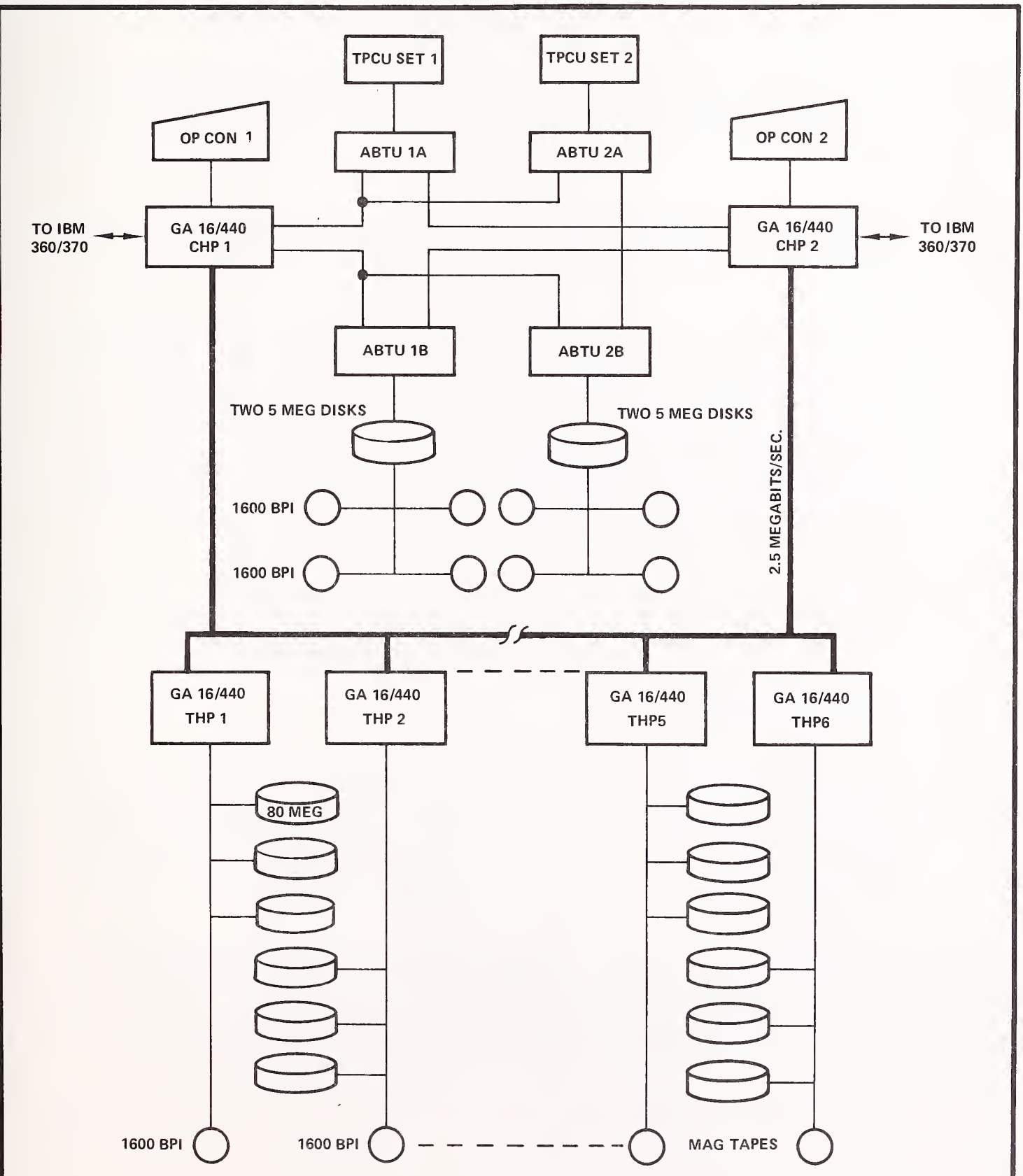
- There are no peripherals at the remote site other than the terminals. No data bases are distributed or maintained at the banking office locations which is done in an effort to maintain centralized control.

- The GA minicomputers are all 16/440 units with 65K words (see Exhibit III-1). They are arranged in clusters of two units each with one cluster acting as dual communications handling processors (CHP) and three clusters functioning as transaction handling processors (THP).

- Each CHP logs transactions and addresses 16 SDLC lines with the facility for taking its companion's communications lines in the event of a processor failure. Furthermore, each CHP can handle two asynchronous lines for ATM transactions.

EXHIBIT III-1

SECURITY PACIFIC BANK DDP HOST



ABTU-AUTOMATIC BUS TRANSFER UNIT
OP CON-OPERATORS CONSOLE
THP-TRANSACTION HANDLING PROCESSOR
CHP-COMMUNICATIONS HANDLING PROCESSOR

- Network control is provided by a PDP 11/05, which is used to check out modems, monitor line problems and detect attempts to break into the ATMS. Operators man the system console on a twenty-four hour basis.

- Several automatic bus transfer units (ABTU) are used within the CHP cluster to allow the switching of communications lines, magnetic tapes and disk drives.

- There are currently three clusters of THPs employing CDC 3345 80 megabyte disks, which comprise the transaction data base.

- Functionally, the system generates a log of activity against a customer file. At the conclusion of the banking day, the log is transferred (by tape) to the central mainframe computer system for the creation of a report of "holds." Various customer record changes such as names, addresses, etc., are also made. A new data base is then generated by the mainframe and loaded on the on-line data base prior to the next day's activities.

- In addition to the CHP and THP clusters, the bank also operates a test system for purposes of program development, checkout and system simulation.

4. RESULTS TO DATE

- Security Pacific National Bank (like most banks) has been traditionally a large mainframe user. This was its first attempt at using minicomputers within a DDP environment and it found many of the niceties missing, particularly with regard to operating systems and documentation.

- Throughput limitations were encountered by virtue of the minis having only 65K of memory and limited space for buffers. In general, the bank had difficulty in debugging mini software, hardware and integrating the processors.

- Critical hardware milestones and the time required to implement them included:

- ITC controller and terminal installation at 528 sites - 12 months.
- ICC Communications Control Center installation - 6 months.
- Shipment of GA hardware for on-site program development - 12 months.
- Installation of the test bed configuration for program development - 6 months.

- Key software accomplishments included:
  - Programming message accountability for update type transactions.
  - Generating a disk recovery system to rebuild on-line data packs.
  - Developing a dynamic data base load facility to reload the data base while still on-line.
  - Establishment of inter-cpu communications.
  - Writing all of the applications for the DDA/TDA functions.
  - Completion of the data base I/O Manager and,
  - Testing the redundancy features.
- Pilot installations were implemented in a few banking offices starting in 1977.
- User acceptance is reported to be excellent, particularly after the initial shakedown period. Much of this acceptance is attributed to a comprehensive training program.

- Communication line problems have been encountered throughout the network. These have been related to extended response times in certain instances and may have been as a result of low quality lines.

- SDLC experience has been favorable, with this protocol being used between the banking office controllers and the CHPs. A modified form of SDLC is used between CHPs and THPs at the host site.

- The system has been operational for over one year and the bank is pleased with:

  - The redundancy features which afford a higher reliability than a uniprocessor system.

  - The relatively low cost associated with redundancy; e.g., the hardware cost of each minicomputer cluster has been approximately $200,000 including disk.

  - The ability to add clusters in a modular fashion as the size of the system increases and future applications are added.

5. THE FUTURE FOR DDP

- The bank's experience with minicomputer front ends has been quite favorable and minis will be considered for future on-line activities.

- Mainframes will continue to be used for data base related applications.

- Future operations may implement selected real time posting of transactions to accounts rather than the current time delayed memo posting process.

- Although data bases are not planned to be distributed among banking offices, additional remote intelligence requirements are perceived; particularly in manipulating screen masks.

- Security Pacific has two ATM installations in a pilot mode with nine more planned in the short term.

- The same data base used to service DDA and TDA transactions is also used with the ATMs.

- Future applications might also include:

  - Development and DDP integration of additional loan applications such as a data base to service commercial loans and,

  - A broadcast facility to disseminate information items of interest to banking offices throughout the network.

B. DISCRETE MANUFACTURING

1. INTRODUCTION

- As a result of related work that INPUT has performed, it is our belief that the discrete manufacturing sector represents the most promising market area for DDP.

- Interviews conducted with a variety of Fortune class companies have indicated that many of these firms have been implementing DDP for extended periods of time.

- The following case study was selected for profiling in this user experience report because it deals with one of the more sophisticated future DDP planning efforts that INPUT has been exposed to in discrete manufacturing.

- This results from approximately two years of DDP experience collected through a number of trial installations which to date have yielded marginal results. Nonetheless, future expectations for DDP remain exceedingly high and the company has now embarked upon an aggressive program to implement fully a "second generation" system.

- Accordingly, the bulk of this profile will be directed toward highlighting how the lessons learned to date have structured the company's DDP philosophy and current thinking regarding its future networking requirements.

2. COMPANY OVERVIEW

- The Byron Jackson (BJ) Pump Division of Borg Warner, about whom this profile is written, is the largest of several divisions within Borg Warner's Energy Equipment Group (EEG). This group services the industrial products market by supplying pumps, valves, seals and other key capital goods components.

- Borg Warner is a diversified, multinational manufacturer of a variety of products used in air conditioning, chemicals and plastics, transportation equipment, and industrial products. Total corporate sales have increased at a compound rate of 11% over the last five years and reached $2.03 billion in 1977.

- The Industrial Products Group (which includes EEG) has exhibited a 13% compound sales growth since 1973 and is the most profitable operating entity within the corporation with 1977 sales of approximately $435 million. EEG annual sales represent approximately 60% of this total.

- There are a total of five major product and service groups within Borg Warner. However, the Industrial Products Group is the only one of these five doing work in DDP.

- Byron Jackson, with over 5,000 employees, operates manufacturing plants in Los Angeles (division headquarters), Tulsa, The Netherlands, Canada, Australia, Argentina and Mexico. There are approximately 15 service centers and 54 sales offices worldwide.

  - The current DP staff numbers approximately 70 people worldwide and operates on a $3 million annual budget, which has recently been growing at about a 20% compound rate. The Director of Management Information Systems reports directly to the President of BJ.

3. DDP BACKGROUND

- BJ's move toward DDP began in 1973 when the company became interested in developing a remote computing capability as an improved means of satisfying user requirements for more timely information reporting.

  - Available products were judged to be unsatisfactory in meeting specifications formulated to satisfy stipulated requirements.

- In 1975, DDP was re-examined from an expanded perspective:

  - As a tool to be used in aiding a growing move toward a more decentralized operating structure and,

  - In converting its DP philosophy away from a customized applications approach and distributing functions under data base control.

- An internally staffed project team (named Delta) was organized to examine the three basic DP functions:

  - Input.

  - Output.

  - Storage and processing (data base concepts).

  The group evolved a set of rules to control the fragmentation of the above functions and prevent the "customizing" of these activities at remote sites.

- Adopting a DDP approach was the most viable solution proposed by Delta and was subsequently approved by the MIS Steering Committee, which included senior operating management within the EEG.

- In order to gain operating experience with the DDP concept, several trial installations were implemented in 1976. These systems, built around IBM's 3790 Communication System, were planned to be installed in Los Angeles and Huntington Beach, California, as well as in Tulsa, Oklahoma, and The Netherlands.

- Four major objectives were identified and included the following:

  - The installation of IBM's Systems Network Architecture (SNA). Communications disciplines are regarded by BJ as the key to successful

DDP. It is believed that SNA will become an effective network standard, and its early adoption will facilitate any future moves toward an integrated corporate network.

- Conversion of several critical data base applications and input structures to the user nodes; e.g., accounts payable, master scheduling, purchasing, etc. However, it is important to note that the basic intent behind EEG's DDP efforts is to move functions out of the host rather than applications (see the operating philosophy discussion in Section D).

- Testing in the user environment and,

- Training the remote staff to be able actively to use the DDP tools provided (including on-site programming) rather than just functioning in a downloading mode.

- Primary data base applications included the usual mix of business related jobs (order entry, sales analysis, accounts receivable, general ledger, etc.) as well as manufacturing applications including scheduling, inventory control, purchasing, routing, shop floor and quality control.

- The problems encountered were primarily centered on the conversion of key data base applications and dealt with the host software, microcode and I/O requirements relating to the 3790.

  - It was clearly not intended to operate the 3790 as a simple RJE station but rather with full capability as a remote, intelligence based processor operating on required applications.

- Development continued through an 18 month period, with the first two goals (SNA installation and applications conversions) generally being accomplished.

- SNA was indeed implemented through the installation of the virtual telecommunications access method (VTAM) resident on the host 370/158 computer and

a network control program (NCP) functional within a 3705 communications controller. Approximately six months were required to complete this task fully.

- Synchronous Data Link Control (SDLC) line protocol was also implemented with 3775, 3776 and 3777 communications terminals.

- Host site testing was completed and system test begun in the user environment approximately one year after the start-up. Significant problems were encountered, particularly with 3790 microcode and host software support.

- The 3790 sites were intended to operate in four fully integrated modes including:

  - RJE.

  - Standalone.

  - Being capable of operating on-line to the host from remote terminals by means of CICS (customer information control system); i.e., on-line compatibility.

  - Exercising the capability to search for information within the remote data base and, if unavailable, accessing the host data base automatically; i.e., remote site transparency.

- Although each of the above modes of operation were implemented, they proved not to be functional in what was regarded as a sound technical and operational manner.

  - Furthermore, remote site programming has proven to be extremely difficult.

4. THE OPERATING PHILOSOPHY AND APPROACH

- As a result of the preceding experiences, EEG has formulated a communications network philosophy and a set of rules to control processing and data fragmentation. INPUT believes that these are worthy of review.

- In general, it is EEG's thesis that conventional network thinking is counterproductive to implementing data bases and has spawned the following types of problems:

  - New technology introduced to provide additional applications leaves earlier applications with more expensive and less efficient technology.

  - Each application generates its own unique I/O requirements, limiting standard approaches and sharply increasing network overhead; i.e., increasing marginal costs that offset gains from economies of scale.

  - Mixing technologies (old vs. new) tends to reduce the favorable benefits of new technologies.

  - The development of multiple applications, with their increasing network demands, aggravates the problem of maintaining control.

- EEG believes a network should be designed to:

  - Be flexible enough to accommodate change.

  - Introduce new technology with minimum disruption.

  - Minimize marginal DP costs.

  - Maximize data base strategies.

- Centralize overhead in order to gain the advantages of economies of scale while decentralizing direct DP costs to the user.

- Maintain hardware, communications and software consistency in its use of data bases, leased lines, etc.

- Provide checks and balances between user requirements and DP management controls.

- EEG refers to its conceptual solution to these objectives as Functional Network Architecture (FNA), which stresses input, output, and data base functions rather than payroll, shop loading, inventory control or other types of applications or services.

- Three basic control systems have been established for input, output, and data base functions. In conjunction with these control systems a set of ancillary policies have been adopted whereby:

  - The maximum amount of hardware, communications and software overhead is centralized; e.g., access methods, the DBMS and protocols are all centralized.

  - Network attached equipment is centrally ordered and leased where practical.

  - On-line and batch I/O programming capabilities are decentralized; i.e., conducted at remote sites.

  - I/O storage and restart controls are decentralized.

- Furthermore, all data elements, standard processing routines, master file structures and I/O interfaces are centrally controlled.

- These policies serve to distribute capabilities and responsibilities for I/O while maintaining centralized control over all data management activities. The central site is responsible for high overhead and long lead time functions generally associated with storage and processing, while the remote sites are responsible for quick reaction to user output requirements and maintaining the highest level possible for input quality.

- A system of checks and balances has been implemented to accomplish the above functions and consists of the following organizational units:

  - An MIS Steering Committee concerned with satisfying both tactical and strategic issues necessary in developing and improving the business strengths within EEG.

  - System Management Teams which are responsible for developing annual system plans submitted to the MIS Steering Committee and,

  - Project Teams charged with the responsibility of conducting the delegated work tasks.

5. THE FUTURE FOR DDP

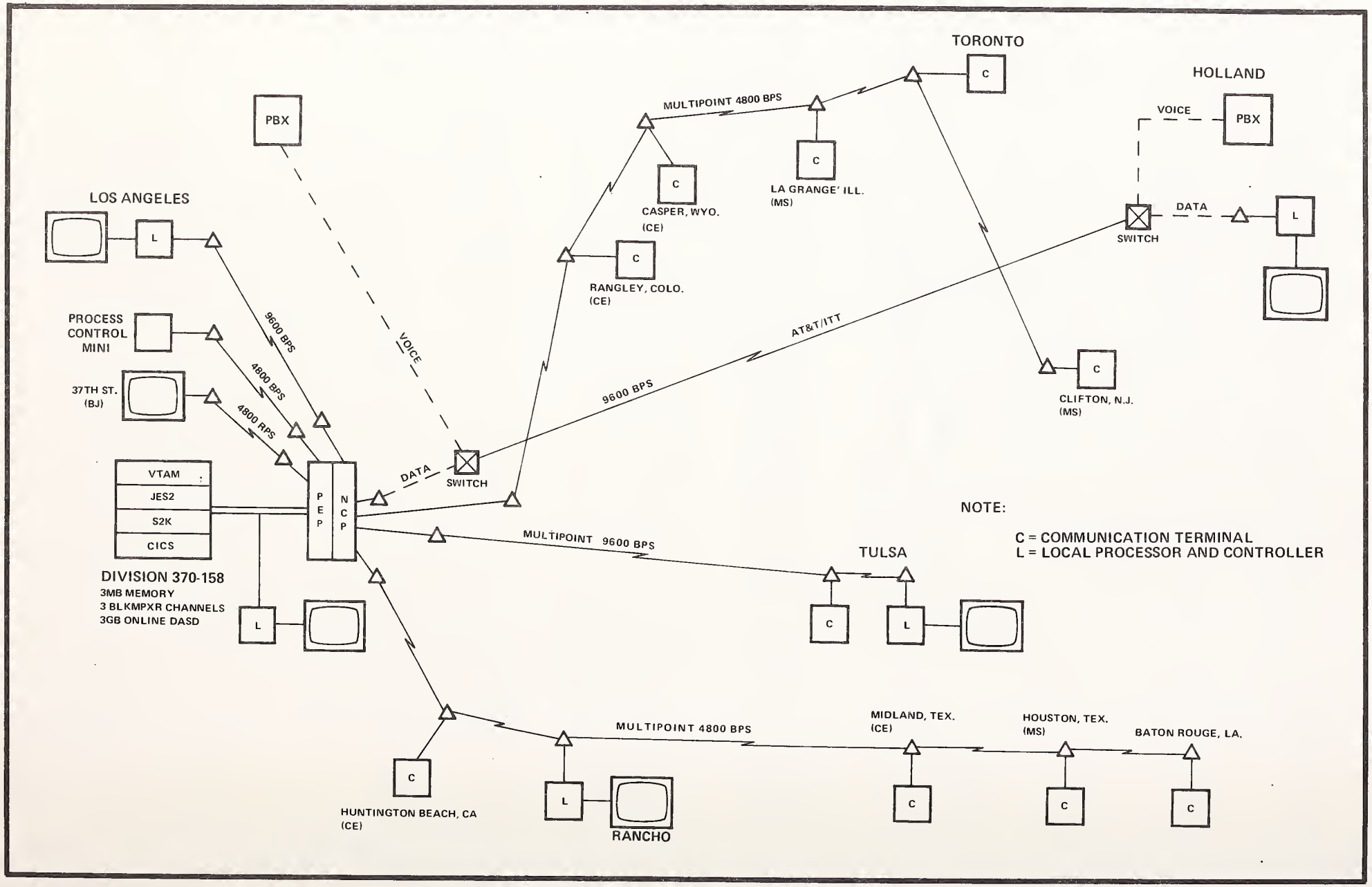
- Against the above background of operating experience and network philosophy, EEG is poised to implement its "second generation" DDP system to support its multinational manufacturing operations. The system is intended to handle the basic spectrum of manufacturing systems, from process control through job shop control, including any hybrid mix of the two and to accommodate fluctuations based on product mix changes and strategic plans.

- EEG's proposed network is illustrated in Exhibit III-2.

- The current configuration (which is basically identical to the proposed network) consists of a 3 megabyte 370/158 host computer with VS1, VTAM, CICS, JES2 and a System 2000 Data Base Management.

EXHIBIT III-2

PROPOSED NETWORK BORG WARNER ENERGY EQUIPMENT GROUP



- Remote processing units or RPU sites (a euphemism adopted by EEG to distinguish its remote programmable intelligence sites from the central site or CPU) operate both RJE-Batch and Interactive Mode (to host) as well as standalone at the remote. These are currently the 3790 units.

- A General Automation 16/440 is used for both shop data collection and controlling numerical machine tools. It interfaces with the host directly using 2780 emulation. Currently, a 3790 interfaces with 15 terminals in the same facility in order to access the host data base. Both the 16/440 and 3790 may eventually be replaced by a single RPU.

- Future system requirements will continue to use SDLC as the line protocol.

- Each remote site, in addition to a transaction oriented processor, will nominally consist of:

  - 100 megabytes of disk.

  - 15-25 terminals to support both RJE and on-line operations.

  - 2-3 serial and line printers.

  - Tape drives to run both microfiche and tape to printer data conversions.

- It is important to emphasize that the future remote site must satisfy the hardware, software and communications requirements to facilitate the aforementioned RJE, standalone, on-line compatibility and remote site transparency requirements.

- Procurement plans are uncertain at this time as to whether a single vendor will be selected (consistent with SNA/SDLC requirements) or multiple vendors with their respective equipment servicing dedicated functions (or applications as appropriate).

- Key vendor selection criteria will focus upon:
  - Hardware and software functionality.
  - Lead time for hardware delivery (120 days after completion of contract negotiation).
  - Ease/difficulty of maintenance.
  - Ability to write code at the node.
  - SNA compatibility (it is possible that Borg Warner's four other major operating groups may elect to employ SNA in the future resulting in a corporate network capable of being integrated by means of IBM's Advanced Communications Function).
- Every effort will be made to retain the 370/158 through 1980 as functional requirements are offloaded to the remote sites. The System 2000 DBMS will be refined and improved at the host.
- The current and proposed network will also handle voice, telex, and data traffic. Although there are a number of off-line IBM System 6 word processors within EEG, there are no current plans to integrate an electronic mail function with the proposed network.

C. HEALTH INDUSTRY

1. INTRODUCTION

- In conducting DDP and related research, it has become clear that there are many areas where relatively small users can reap the benefits of using DDP without necessarily making large investments in time, personnel and hardware. A variety of services are becoming increasingly available which offer viable DDP solutions to small users.

- These services are provided by remote computing service (RCS) vendors who employ large mainframes as hosts in a DDP network. Various users may occupy single or multiple nodes within the network.

- This approach appears to have a great deal of appeal for small but geographically dispersed companies or institutions not equipped to deal with the networking implications of DDP.

- Alternatively, single location firms are relieved of the challenges and costs of operating a host facility while availing themselves of its benefits through a DDP network.

- This profile describes a California hospital utilizing an RCS network--an increasingly viable, but different approach to DDP.

2. HOSPITAL OVERVIEW

- Mt. Diablo Hospital Medical Center is a non-profit district hospital located in Concord, California. It traces its origins back to 1930, although its current 303 bed facility was dedicated in 1975.

- The hospital employs 1,200 personnel and services an area populated by about 400,000 people. The current annual operating budget is approximately $34 million with roughly 99% of funds derived from patient and third party billings.

- In addition to general medical/surgical nursing care units, the hospital offers a variety of critical care units, a Diagnostic-Therapy Center which provides cobolt treatments for cancer patients, a hemodialysis unit, and special maternity and infant programs.

- There are 36 specific medical departments within the hospital which are supported by 41 identifiable groups including:

  - Planning.
  - Personnel.
  - Finance.
  - Administration.
  - Education and training.
  - Public relations.

- The DDP department reports to the Director of Finance and currently operates with about eight staff members and a monthly budget of $24,000. This does not include a separate budget for a laboratory minicomputer system which functions independently of the profiled DDP installation.

3. DDP BACKGROUND

- Mt. Diablo's data processing experience dates back more than 10 years with its most recent installation (prior to installing a DDP node) consisting of a used NCR Century 200 and HP 2100. The HP machine was used for data collection

at nursing stations and provided information to the NCR "host" via computer compatible magnetic tape.

- Both computers were physically separated by a city block and required a staff of six full-time programmers to satisfy software requirements.

  - The monthly operating budget under these conditions was approximately $32,000 which included $1,500/month for maintenance of the NCR machine alone. The overall average hourly service cost was about $600.

- Difficulties were being encountered by the in-house programming staff in providing software in a timely manner to satisfy various user requirements.

  - Some programming tasks were estimated to require one year to become operational.

- Additional problems included:

  - Programmer difficulties in mastering the very diverse user requirements to be found in a hospital like Mt. Diablo with its large number of medical and administrative departments and functions.

  - Operating in a multi-vendor environment with attendant service and maintenance problems.

- A variety of alternative solutions were examined approximately 18 months ago including the possibility of upgrading the existing hardware. This latter approach was eventually rejected for the following reasons:

  - The relatively large depreciation charges associated with owned hardware.

  - The service and data accuracy problems associated with the installed keypunch equipment.

- The costs and related difficulties of maintaining an in-house programming staff.

- Concern over the rapid obsolescence of purchased equipment.

- One of the alternatives examined (and eventually selected) was to exercise the option of choosing a remote computing service (RCS) vendor specializing in the health care field. The company chosen was Shared Medical Systems (SMS) headquartered in King of Prussia, Pennsylvania.

- Perhaps the most pivotal factors contributing to the selection of an RCS vendor were the reduced operating cost and the immediate availability of specialty software packages to satisfy the diverse needs of a hospital.

- SMS, with annual revenues in excess of $50 million, offers a variety of hospital related applications services generally divided into the following categories:

  - Financial Management including patient and insurance company billing, accounts payable and related financial statistics.

  - Resource Management including payroll, personnel, inventory, etc.

  - Patient Care, which offers a variety of specialty packages applicable to admissions, pharmacy, laboratory, outpatient, etc.

- SMS also provides archival storage services for its clients.

- These services are provided to more than 400 hospitals in about 37 states by means of a private wire communications network utilizing dual 370/168-3AP hosts at corporate headquarters. Each of the subscriber hospitals represents a minicomputer based DDP node in the network.

- Participants in the decision to select an RCS approach (and SMS as the vendor) included the:

  - Director of Finance and Comptroller
  - DP Manager
  - Hospital Administrator
  - Board of Directors

- The equipment which was installed (on lease) within Mt. Diablo includes a Four Phase IV/40 clustered-video display processing system which controls four CRTs, a printer, and a 2.5 megabyte disk. The NCR and HP 2100 equipment were removed and sold in May, 1977, approximately two months after SMS was brought in.

- Cost savings were achieved simply through reductions in staff (particularly programmers), increased accuracy in data entry by replacing keypunch machines with terminals and eliminating equipment related depreciation charges.

- The system became operational in May, 1977. Key applications and the time required for their implementation included:

  - Patient accounting and census - two months.
  - Accounts payable - three days.
  - General ledger - one month.

  Most of the remaining applications required about two months to install/convert.

- In addition to the SMS packages, Mt. Diablo also uses two other (non-SMS) software services offerings including:

  - A statistical budgetary system providing payroll hours, average hourly salary per department, etc., provided by Amherst Budget Systems in Illinois.

  - An inventory ordering and buying system operated by California Data Services in Irvine, CA. Hospital data is transmitted directly to Irvine for processing.

4. RESULTS TO DATE AND FUTURE PLANS

- Average monthly charges for the SMS installation have been in the $9,000-13,000 range and include all lease, teleprocessing and service costs. This has resulted in about a 25% cost savings in the DP department largely as a result of the elimination of six full time programmers.

- Vendor hardware and software service experience to date has been very good.

- Users are generally quite pleased with the sharp improvement in the timeliness of reports; e.g., census information is distributed by 7:00 AM which materially contributes to smoother routines in bed allocation and meal preparation.

- Alternatively, the hospital has lost some flexibility in being able to service special department requests.

- Within the next 12 months, Mt. Diablo expects to upgrade its existing installation to the equivalent of a Four Phase IV/70 cluster controller with a capability to handle 20-24 distributed terminals. Emphasis is on increasing accountability (responsibility) of individual departments in the reporting and data entry functions. Two more printers will be added in addition to upgrading disk capacity to 10 megabytes or greater.

- The existing lab system (using a Digital Equipment Corporation processor) may be tied into the Four Phase equipment by means of a compatible tape. Laboratory charges (of which there are hundreds daily) are still keypunched with obvious room for improvement.

- Selected applications which are currently performed in a batch mode will be done on-line and will include:

  - Master patient index.

  - Patient admitting.

  - Bed availability.

  - Patient census and billing.

  - Patient charges including X-ray, pharmacy, etc.

- Although the hospital has been well satisfied with the RCS approach and expects to continue using this method in the short term, it has not ruled out the possibility of reverting back to an in-house approach at some future date. This will be contingent upon further declines in computer system pricing in conjunction with the availability of customized or packaged software systems.

D. PROCESS MANUFACTURING

1. INTRODUCTION

- The process industries by virtue of their wide geographical dispersion (much like the discrete manufacturing sector), represent a particularly attractive area for using a DDP methodology.

- However, the actual implementation of DDP could represent an extremely challenging undertaking, particularly when the company in question may have a number of quite diverse operating groups.

- This is true in the following profile of a large multinational corporation with diverse information processing requirements in both its chemical and materials businesses.

  - The chemical operations are oriented toward engineering applications and plant business systems.

  - The materials group is more concerned with process control and automated warehouse applications.

- Problems are further compounded by a proliferation of multivendor equipment currently operating in batch, on-line and interactive modes. This has spawned, in some instances, three networks servicing the same facility.

- The company's identity is not disclosed.

2. COMPANY OVERVIEW

- The company is a multinational diversified manufacturer within the petrochemical industry.

- Recorded sales for the most recent reported fiscal year were in excess of $2 billion and the company has experienced a 10% annual compound growth in sales since 1973. Materials and chemical operations represent the two largest product groups.

- Worldwide employment for the corporation and consolidated subsidiaries are in excess of 30,000, with approximately two-thirds of this total employed domestically. Major operations are heavily concentrated in both the southeast and southwest. International facilities are to be found in Europe, South America, Canada and Mexico.

- The data processing function was centralized at the corporate level in the late 1960's in order to increase standardization and enhance operational control. The DP budget of $12 million supports a staff of 250 domestically.

3. DDP BACKGROUND

- Prior to 1977, a variety of corporate and individual company level systems had been developed in an effort to satisfy sharply diverse requirements among the materials and other manufacturing operations.

- These diverse requirements were satisfied by placing the data processing function at the local level. However, this spawned multiple types of networks and terminals such that there are now installations that may have as many as three sets of communications lines (with different types of on-site terminals) in order to service:

  - Remote job entry stations collecting data for batch operations.

  - On-line order entry applications coupled with administrative traffic and,

  - Interactive program development.

- Furthermore, the company identified some years ago the need increasingly to automate warehouse level functions. Accordingly, it adopted a "three level" form of DDP system. This has been implemented in one network thus far whereby warehouse control operations (level one) provide data to minicomputers (level two) for purposes of inventory control and stores replenishment. Summary information is then passed on to a 370/138 (level three) computer which then interfaces with the host.

- An initial installation of an IBM Series/1 to perform warehouse related functions has also been implemented in one of the materials plants.

- All of the preceding has served to create a multiple vendor equipment environment (see Exhibit III-3) including:

  - Data 100 RJE stations.

  - IBM 370/138, 370/148, 370/165, 370/168, Series/1, 3790 and 3270 terminals.

  - Xerox computers.

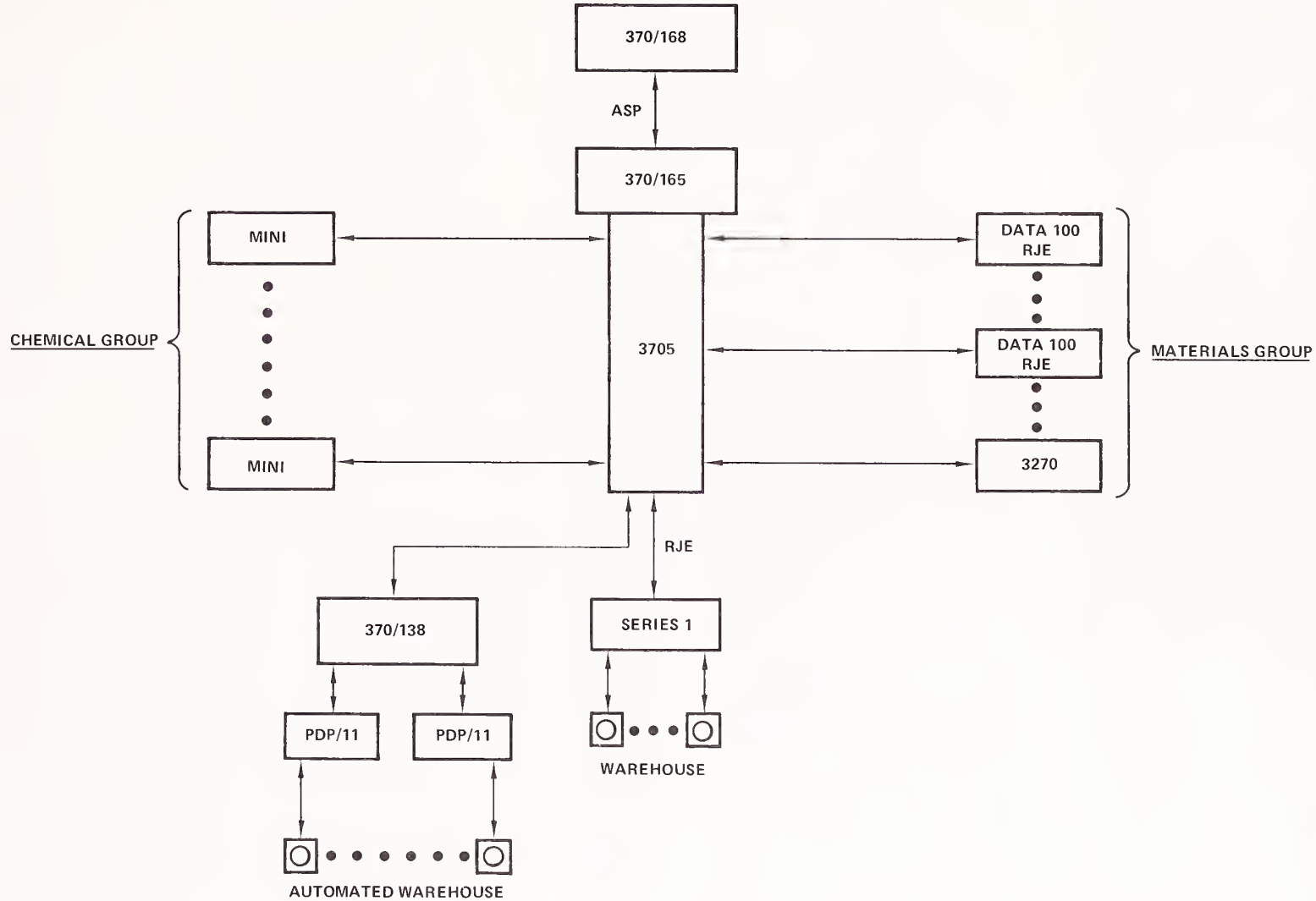
  - Digital Equipment Corporation (DEC PDP/11) minis.

  This equipment operates in a domestic network with extensions to Canada, Brazil and Belgium for message traffic.

- Early in 1977, Network Services (a corporate entity charged with responsibility for operations, technical development, and support and maintenance) was reorganized with increased responsibility in providing long-range planning and plant support for the materials and chemical operations.

- A primary motivation for this action, and the group's subsequent involvement with DDP, relates to management's concern with the large capital expenditures at the host center and the obvious redundancy of network facilities.

PROCESS MANUFACTURING DDP NETWORK



NOTE

1. ANOTHER GROUP OPERATES ITS OWN NETWORK WITH A 370/148 HOST
2. AN AFFILIATED COMPANY OPERATES RJE INTO THE HOST WITH A SUB-NETWORK OF 3741's

- One of the group's pressing tasks is to attempt to get standardized and uniform systems installed across divisional lines. It must do so against a background of diverse user requirements and a plethora of vendors offering non-standard sets of equipment.

- Although it is intended to continue to have all programming centralized, a trained software professional(s) will be in residence at remote sites to take care of ad hoc requirements.

4. EFFORTS TO DATE

- In examining methods that might be employed to satisfy the preceding requirements, Network Services undertook a detailed study of each major system that was needed within one of the operating groups and examined a number of different possible solutions. These included batch, RJE, DDP and the use of regional processing centers.

- A detailed evaluation of the costs associated with teleprocessing, staffing, hardware, space, etc., was performed for each of the above proposed solutions.

- Key factors that were also examined included:

  - The time required to perform various functions.

  - Maintenance and location support requirements at the remote sites and,

  - The architectural intent of various vendors' equipment; i.e., where the product stands in its development cycle and its capability of being upgraded.

- The company selected a minicomputer based DDP approach as being the most cost effective in satisfying the disparate processing requirements for both major operating groups.

- Both the IBM Series/1 and the DEC PDP/11 machines (which have been operational for some time) were selected (at different intervals) as representing the best hardware solutions then available for the particular applications in question. They will be considered as candidate minicomputer types to satisfy future automated warehouse applications.

  - Results will also be compared with the 370/138 system operating with CICS and DL 1 installed at one of the materials plants.

  - This facility has been operational for at least six months but will require additional experience before yielding results suitable for "before vs. after" comparisons.

  - Experience with one installed 3790 has yielded satisfactory results as far as IBM's specifications are considered. However, the product's operating limitations may not be adequate to satisfy the proposed automated warehouse application.

- The Series/1 is currently operating in a non-automated warehouse application and providing batch data to the host.

  - Interactive processing is not needed for some plants, which results in emphasis being placed on summary data derived from remote batch inputs.

5. THE FUTURE FOR DDP

- The company will continue to operate with both its RJE and on-line terminal systems. However, card readers will probably continue to be used for several more years.

- Studies are underway to convert the existing multiple networks effectively into a single network populated by one terminal type capable of performing all functions; i.e., RJE, on-line and interactive.

- SNA is being considered as the network standard, and potential vendors' equipment is being examined with regard to the extent that it will be SNA/SDLC supported.

  - It is important to emphasize that other protocols and network standards are also being evaluated.

  - A decision is not expected for about 12 more months.

- In the software development area difficulties have been encountered as a result of minicomputer limitations in data base handling.

  - Since the Series/1 does not have a DBMS, the company is developing a data base handler for its initial installation.

  - TOTAL is being satisfactorily used on the DEC equipment.

- It is important to emphasize that philosophically the company is not committed to a more centralized network structure. They desire to have a DBMS more localized to the distributed minicomputer installation with relatively small amounts of summary data transmitted to corporate headquarters or among various locations.

- The concept of a corporate wide and centrally controlled DBMS is regarded as inconsistent with:

  - The current and expected availability of such a product.

  - The need to take advantage of current technology that affords economical solutions to the DP requirements of remote locations.

  - A desire to control the growth of corporate network services.

- Over the next 15-18 months, the following sequential milestones are expected to be achieved for the chemicals division:

  - Complete the evaluation and selection of a second generation minicomputer family. The IBM System 34 is a viable candidate to satisfy the business systems capabilities.

  - Develop a functional specification for the first major application.

  - Complete installation of the first system in the proposed network operating with a major application.

E. RETAILING

1. INTRODUCTION

- The following user experience profile describes one of the earliest and most sophisticated point-of-sale (POS) oriented DDP networks encountered by INPUT in retailers with sales below one billion dollars.

- The timeliness of DDP information reporting in the dynamic retail environment sharply facilitates the company's operations.

- The system has been implemented as both a sales aid and planning tool for dealing with building supply contractors and consumers of hard goods.

- It is unique in that the system is completely designed and maintained by the company with limited vendor dependence. Major system components have been centrally procured and assembled by the company.

- Resulting financial information supported by sufficient operating experience indicates that DDP does offer tangible cost/performance benefits over more traditional centralized DP operations.

- This DDP network currently has a limited data interface with the company's suppliers but could become a future model for integrating the order function between wholesalers and retailers in the distribution industries.

- The company's identity has been withheld by request.

2. COMPANY OVERVIEW

- The company is a major regional building materials and hard goods retailing chain with 185 stores in 16 eastern states.

- Products sold to both contractors and consumers run the gamut from structural lumber, building hardware, plumbing and electrical supplies to kitchen and laundry appliances, housewares, home entertainment equipment and mobile homes. There are approximately 10,000 merchandise items for sale which have spawned two million stock keeping units (SKUs) in the central inventory file.

- The company had net sales in excess of $600 million in its most recent reported fiscal year and has had approximately a 17% compounded growth in sales over the previous four years. The rate of annual store expansion has averaged about 14% which, if sustained, should approach the corporate goal of 300 stores by 1981. The company's productivity, profitability, rates of growth and financial performance measurements compare very favorably with leading retailers.

- Approximately 5,000 people are employed by the company with about 110 personnel in the data processing area. Of the latter, 30 are involved in the DDP program with the remainder assigned to centralized functions.

  - The data processing budget, exclusive of capital expenditures, has averaged about 0.5% of sales in recent years.

3. DDP BACKGROUND

- The implementation of a point-of-sale (POS) data system dates back 15 years (when sales were less than $50 million) and has been an integral part of the company's long-range plan to develop an effective sales/planning tool to facilitate its growth.

- Philosophically, the company perceives itself simply as a marketing firm, buying and selling merchandise with the underlying sales function as the most important activity to be performed in its business environment.

- Accordingly, the data processing function (among others) is seen as proposing "least expensive" solutions to facilitate the salesman/customer interface, with the use of computers as incidental to the stated objective.

- The company's recent POS efforts traces its origins back to the 1972/73 time frame. Prior to this point in time, it evaluated and tested a variety of alternative system solutions and distributed network implementations that included:

  - Optical scanning and ticket reading (Kimball).

  - Key-to-disk.

  - Mail and courier services.

  Data I/O was the limiting factor in the above solutions.

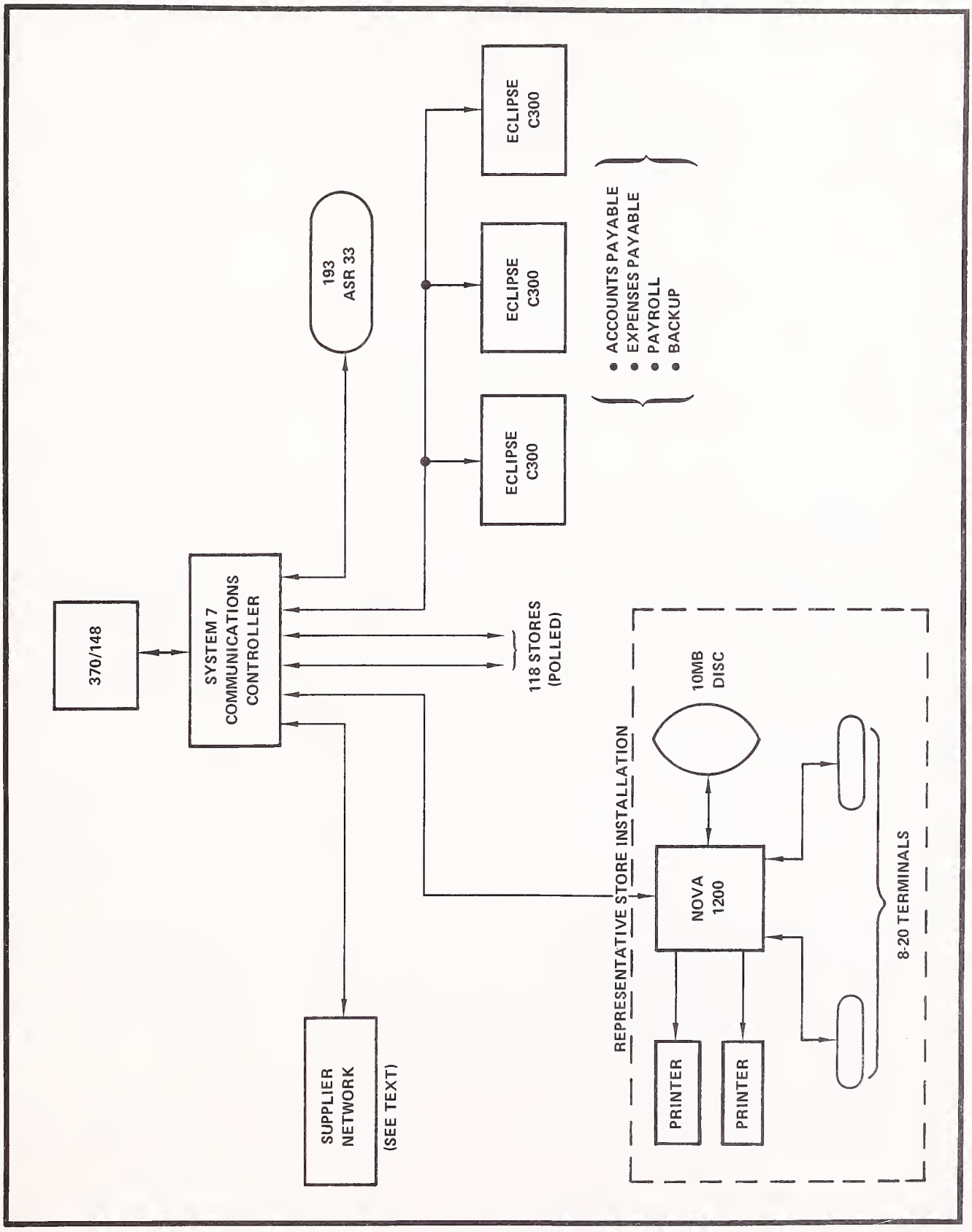
- The current DDP system (see Exhibit III-4) is built around a 370/148 host which interconnects with three Data General Eclipse 300 processors. The latter handle accounts and expenses payable as well as personnel applications. Both IBM 3270 and Applied Digital Data Systems (ADDS) terminals support the host facility.

- An IBM System 7 acts as the communications controller with each remote node (retail store) looking like a 2780 to the 370/148. The System 7 is currently being evaluated for replacement or upgrade. The communications protocol is binary synchronous (bisync) operating over 2,400 bits per second (bps) dial-up lines.

- Less than one minute per day per remote site is required to transmit the necessary store/host data, which includes an inventory update as well as automatic resupply and price adjustment information. Data compression techniques are used to facilitate these transmissions.

EXHIBIT III-4

RETAIL DDP NETWORK



- Currently, 118 of the 185 total stores are operational in the DDP network. Store equipment includes the following:

  - One Data General Nova 1200 CPU with 65K bytes of memory.

  - Eight to twenty low profile (facilitates installation at check-out counters) custom CRT sales terminals (initial units were Conrac).

  - One Diablo 10 megabyte disk.

  - Two printers made by Centronics and Tally.

  - One ASR-33 asynchronous terminal for administrative message traffic.

  - One ADDS control terminal for accounts receivable and credit authorization.

- In addition to the store interconnection there exists a secondary network that permits suppliers to establish a communications link with the company in order to facilitate ordering and billing. Although only three of the company's 150 major suppliers are currently on the system, the future potential for a wholesaler/retail DDP network is extremely intriguing.

- Key accomplishments in the implementation of the system included:

  - Developing a duplicate POS billing system that required 120 days.

  - Bringing up an accounts receivable system for purposes of credit authorization and the local printing of statements that also required 120 days and,

  - Developing a unit inventory or real time inventory system that required almost one year.

- Significant early software difficulties were encountered in attempting to handle a relatively large number of terminals without the benefit of a more powerful operating system, or virtual memory, in a small machine.

- The first in-store system required one year to become operational with the second taking nine months. Since that period, the company has sharply decreased the time necessary to bring a store on-line. It is now down to several days.

- It is instructive to note that each store maintains its own inventory file which is duplicated at the host. Each time a sale is made, the item is deducted from the local inventory coupled with an appropriate addition to the receipts record. Periodic physical inventories serve to reconcile differences between host and remote records.

- The retail store environment proved to be far more hostile than expected. Equipment filters were unable to handle dust and smoke (from fork lift trucks) and disk packs were being discarded every three weeks. The company resorted to custom cabinets operating under positive pressure and without using external air for cooling.

- The most important criteria used in selecting a vendor was cost and maintainability (not surprisingly). The company is unique in that it performs its own maintenance and installation. Major system components are specified and procured centrally from vendors.

- The company did its own system design including developing communications software and establishing its own line protocols. Programming is done centrally and is down line loaded from the host through the System 7.

- Functionally a second communications network exists to handle administrative and special order traffic. There are 193 asynchronous ASR 33 terminals to handle this function.

- FORTRAN IV is currently being used with the in-store minicomputer. Difficulties in retaining programmers, who have written assembly code for the 370/148, are causing a shift to COBOL.

4. RESULTS TO DATE

- Management's experience with the current DDP system appears to be outstanding and includes the following favorable results:

  - Data is significantly cheaper to acquire.

  - Information is available in a more timely fashion. These include administrative reports related to accounts receivable and monetary figures enabling rapid decisions related to the disposition of cash at each store.

  - Relatively untrained people are able more effectively to operate a business.

  - Procedures are more effectively enforced.

- To underline the above in a more quantitative fashion, the following statistics are offered by management:

  - Store operating pretax margins have improved by 2%. It should be noted that sales personnel have authority to lower prices in order to meet competition. The in-store system permits management quickly to pinpoint difficulties that may arise in using this "negotiated price" sales approach.

  - The capability of maintaining an in-store unit inventory has materially contributed to reducing shrinkage from about 1% to below 0.4%.

- Average in-store system costs have scaled down over the last five years from in excess of $100,000 to about $35,000 with a payback of less than three years.

- Each store pays for its own system hardware, and the corporate data processing center is charged with all operating costs. These costs are reported to be more than offset by cash and price discount savings achieved through centralized bulk purchasing.

- On the negative side, the company has had to deal with the design and maintenance issues surrounding a complex network. It elected to do so after satisfying itself that vendors were not in a position to satisfy their particular operating requirements.

5. THE FUTURE FOR DDP

- Over the next two years the company expects to have 250 stores in operation with all stores having an installed computer system.

- Within the next year the company expects to select a new minicomputer system to further upgrade its in-store processing capability. Additional performance features may include:

  - Providing security and environment control.

  - Replacing the special order processing network of ASR 33s with a video terminal tied to the in-store minicomputer. This will serve to integrate both the administrative and computer functions into a single communications network.

  - Providing more management types of reports to be printed at the local level detailing operating margins, inventory status, commission sales, etc.

- The 370/148 will be upgraded to handle COBOL with the addition of more memory and disk.

- Several DBMS systems will be evaluated in order to facilitate inventory management.

- The company will continue to examine non-telephone company network alternatives, particularly in interfacing data with those systems belonging to its suppliers. If successful, expectations are for savings in telephone charges.

APPENDIX A: INTERVIEW PROGRAM AND QUESTIONNAIRE

APPENDIX A: INTERVIEW PROGRAM AND QUESTIONNAIRE

- Individuals that were contacted during the course of this study were senior data processing personnel at the host site in each of the respondent firms. They included DP Managers, Vice Presidents, and Directors of Management Information Services/Systems.

- All interviews from which information in these profiles were derived were conducted by means of on-site interviews and were supplemented by subsequent telephone discussions.

  - On-site interviews generally lasted two to three hours.

- The questionnaire used during the field research is included in this Appendix and represents the form from which the great majority of the interview information was gathered.

DDP CASE STUDY QUESTIONNAIRE

A. COMPANY BACKGROUND

1. Description of business

2. Revenue base, five-year compound growth rate, total employees

3. Description of current data processing environment

   - Primary applications
   - Systems hardware diagram (location, function, applications, hardware identification and vendor)
   - Future procurement plans
   - Data processing manager experience profile
   - Data processing expenditures as percent of revenues, relative rate of budget growth (five-year average), size of data processing staff.

B. DDP SELECTION CRITERIA

1. Describe the nature of the problem(s) motivating the move to DDP.

2. How was the decision made to go with DDP?

   - Who was involved?
   - Who made final product selection decision?
   - What alternative solutions/implementations were considered?
   - What factors weighted the decision toward DDP?
   - What cost/benefit justification procedure was used within the corporation?
   - Were there any special hardware/software factors to be considered?

3. Describe the vendor selection procedure.

   - What critical tradeoff parameters were used?

C. DDP IMPLEMENTATION

1. What were the critical milestones in system implementation and their planned versus actual amount of time required?

2. What special software development problems did you encounter?

3. Were there any special pre-installation or operational factors that had to be considered?

4. How long did pilot installation take and what special problems (if any) were encountered?

5. Describe the systems acceptance procedure.

6. How would you rate vendor hardware/software support?

7. Do you have any special communications considerations?

8. What are your plans/implementation regarding distributing data bases?

D. DDP RESULTS

1. What do you now believe to be the positive attributes of DDP?

2. What do you now believe to be the negative attributes of DDP?

3. How would you rate your satisfaction with DDP and why?

   - Variations from planned implementation.
   - Surprises (pro/con)?
   - Financial benefits; i.e., payback, ROI, profit and loss?

4. What would you do differently?

5. How do you see your DDP system evolving over the next two to three years?

6. What do you believe to be the most important factors that will contribute to the success or failure of DDP in your industry?